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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/692,611

10/24/2003

Mohan Chandra

884.B40US1

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21186

7590

09/06/2006

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EXAMINER

RAO, G NAGESH

ART UNIT

PAPER NUMBER

1722

DATE MAILED: 09/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/692,611

Applicant(s)

CHANDRA ET AL.

Examiner

G. Nagesh Rao

Art Unit

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 and 28-39 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 28-39 is/are rejected.
- 7) ☒ Claim(s) 5, 28, 31, and 36 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

***Election/Restrictions***

1) Claims 14-27 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 8/4/06.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2) Claims 5, 28, 31, and 36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 5 recites the limitation of “graphite grains” as depended on claim 3’s limitation of the base container including graphite. Examiner is unclear as to whether the graphite grains refer to the graphite or a separate entity unto itself. This also pertains to claim 31 as it depends from claim 30’s recited claim language.

Whereas claim 28 and 36 refers to a cooling system to conduct heat from a bottom of the crucible preferentially. However examiner is unclear as to how a cooling system could conduct heat from the bottom of the crucible since cooling

and heat are two entirely separate concepts of thermal energy. Applicant is requested to further explain how this limitation is ascertainable.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3) Claims 1-2 and 4-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Pinkhasov (US Patent No. 4,565,711).

Pinkhasov 711 teaches in particular its claim language (Claims 8-11) besides its specification a coating for a quartz crucible (by the way is a hexagonal crystal structure made of trigonal crystallized silica ( $\text{SiO}_2$ ) (10) which as shown in Figure 1, comprised of a base container capable of containing a liquid silicon material and a coating process imposed by vapor generator (13) for coating among many different types of coatings either silicon or boron nitride onto the crucible container (See Col 1 Lines 62-68, Col 3 Lines 26-51, and Col 5 Lines 21-55). This reference also teaches that there is an equivalency between boron and silicon nitride coatings

in particular a quartz crucible which materially would inherently have a CTE of 0.59 which is less than the CTE value of 3 for silicon. Finally the crucible as taught and depicted by Pinkhasov 711 shows the base container being integrally formed and including multiple components, i.e. it is a full container with a bottom and two side walls which would read on integrally formed and having multiple components as it is situated on turntable (11) as it is interacted with components 13 (vapor generator) and the counterelectrode (21).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
- 4) Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of Yamagishi (US Patent No. 5,788,718).

Pinkhasov 711 fails to explicitly teach or include the base container to include graphite.

In an apparatus pertaining to a method for growing for example a single silicon crystal, Yamagishi 718 depicts in Figure 1 a quartz crucible (5) being made of a material that has a CTE lower than silicon but the base container also is comprised of a second tier container below the quartz crucible container (5) with a graphite crucible container (6), and considering the Yamagishi 718 reference teaches coatings of the instruments used in silicon crystal growth including the use of silicon nitride, it is safe to presume this reference is very analogous to the Pinkhasov 711 reference.

It would therefore at the time of the invention be obvious to one with ordinary skill in the art to modify the Pinkhasov 711 reference with that of Yamagishi 718 to include a graphite bottom to let's say a quartz bottom to aid in temperature distribution when dealing with temperature fluctuations for melting

and cooling of crystalline material in the crucible and aiding/preventing crucible breakage, since graphite is a good thermal conducting material.

5) Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of (JP 60141696A).

Pinkhasov 711 from the aforementioned taught a crucible with specified limitations as noted in the aforementioned rejection as noted in section 2, with a boron nitride coating however it failed to teach the additional coating layer of a silicon nitride. Even though Pinkhasov 711 taught that both silicon and boron nitrides were viewed as coating equivalents in the art.

However Pinkhasov 711 fails to teach the additional coating of a silicon nitride on top of per se the boron nitride coated crucible or vice versa.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then on top a boron nitride layer unlike how applicant has claimed the crucible with a boron nitride followed by the silicon nitride layer. However Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but

exemplifies that the additional coating enables good adhesion with a middle layer coating between the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.

Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure any possible contamination from occurring between the crucible and the liquid crystal melt.

6) Claims 8-10, 12, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711) in further view of (JP 60141696A).

Wilson 717 pertains to a crystallization at high pressure apparatus where clearly shown in Figure 1 there is taught a furnace (12) surrounding a crucible (16) that includes cooling system (26) designed to extract heat from the crucible using cooling tubes (28) and which would read on a directional solidification cooling



system and further includes a control gas system (30 and 32) (Also See Col 2 Lines 47-72 and Col 3 Lines 1-75).

Wilson 717 however fails to teach the specified teachings of the particulars of the crucible designed and enclosed in the Wilson 717 apparatus.

However Pinkhasov 711 teaches a crucible that read on the particulars defined in claim 8 and would be ideally suitable to change the crucible of Wilson 717 and enclose the crucible designed by Pinkhasov 711.

It would be obvious at the time of the invention to one with ordinary skill in the art to swap out the crucible taught by Wilson 717 with that of Pinkhasov 711 to further optimize the processing and apparatus conditions pertaining to the particulars of growing a crystalline material like that of single silicon crystal ingots.

However Pinkhasov 711 and Wilson 717 combined teachings fail to teach the additional coating of a silicon nitride ontop of per se the boron nitride coated crucible or vice versa.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then ontop a boron nitride layer unlike how applicant has claimed the crucible with

a boron nitride followed by the silicon nitride layer. However Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but exemplifies that the additional coating enables good adhesion with a middle layer coating between the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.

Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure any possible contamination from occurring between the crucible and the liquid crystal melt. Thus the teachings of JP 696 would further optimize the apparatus and conditions that may be put forth on the hypothetical device taught by Wilson 717 and Pinkhasov 711.

7) Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No.

4,565,711) in further view of (JP 60141696A) in further view of Yamagishi (US Patent No. 5,788,718).

The hypothetical device of Wilson 717, Pinkhasov 711, and JP 696 teaches an apparatus system that reads on applicant's claimed invention (See aforementioned rejection for details). However they both fail to teach the use of a graphite base container along with the crucible.

Yamagishi 718 as explained in the set of rejections pertaining to claim 3, teaches the use of a crucible with a graphite as a material as part of the base container. The reason being that it is a good thermal conductor.

Therefore it would be obvious at the time of the invention to one with ordinary skill in the art to modify the teachings of Wilson 717, Pinkhasov 711, and JP 696 with that of Yamagishi 718 to include a base container comprised of graphite as well in order to take advantage of the material's good thermal conduction as well further optimize the apparatus's processing conditions depending on the material processed.

8) Claims 29 and 31-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of (JP 60141696A).

Pinkhasov 711 teaches in particular its claim language (Claims 8-11) besides its specification a coating for a quartz crucible (by the way is a hexagonal crystal structure made of trigonal crystallized silica ( $\text{SiO}_2$ ) (10) which as shown in Figure 1, comprised of a base container capable of containing a liquid silicon material and a coating process imposed by vapor generator (13) for coating among many different types of coatings either silicon or boron nitride onto the crucible container (See Col 1 Lines 62-68, Col 3 Lines 26-51, and Col 5 Lines 21-55). This reference also teaches that there is an equivalency between boron and silicon nitride coatings in particular a quartz crucible which materially would inherently have a CTE of 0.59 which is less than the CTE value of 3 for silicon. Finally the crucible as taught and depicted by Pinkhasov 711 shows the base container being integrally formed and including multiple components, i.e. it is a full container with a bottom and two side walls which would read on integrally formed and having multiple components as it is situated on turntable (11) as it is interacted with components 13 (vapor generator) and the counterelectrode (21).

Pinkhasov 711 from the aforementioned taught a crucible with specified limitations as noted in the aforementioned rejection as noted in section 2, with a boron nitride coating however it failed to teach the additional coating layer of a

silicon nitride. Even though Pinkhasov 711 taught that both silicon and boron nitrides were viewed as coating equivalents in the art.

However Pinkhasov 711 fails to teach the additional coating of a silicon nitride ontop of per se the boron nitride coated crucible or vice versa.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then ontop a boron nitride layer unlike how applicant has claimed the crucible with a boron nitride followed by the silicon nitride layer. However Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but exemplifies that the additional coating enables good adhesion with a middle layer coating between the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.

Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure

any possible contamination from occurring between the crucible and the liquid crystal melt.

9) Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pinkhasov (US Patent No. 4,565,711) in view of Yamagishi (US Patent No. 5,788,718).

Pinkhasov 711 fails to explicitly teach or include the base container to include graphite.

In an apparatus pertaining to a method for growing for example a single silicon crystal, Yamagishi 718 depicts in Figure 1 a quartz crucible (5) being made of a material that has a CTE lower than silicon but the base container also is comprised of a second tier container below the quartz crucible container (5) with a graphite crucible container (6), and considering the Yamagishi 718 reference teaches coatings of the instruments used in silicon crystal growth including the use of silicon nitride, it is safe to presume this reference is very analogous to the Pinkhasov 711 reference.

It would therefore at the time of the invention be obvious to one with ordinary skill in the art to modify the Pinkhasov 711 reference with that of Yamagishi 718 to include a graphite bottom to let's say a quartz bottom to aid in

temperature distribution when dealing with temperature fluctuations for melting and cooling of crystalline material in the crucible and aiding/preventing crucible breakage, since graphite is a good thermal conducting material.

10) Claims 35-36 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711).

Wilson 717 pertains to a crystallization at high pressure apparatus where clearly shown in Figure 1 there is taught a furnace (12) surrounding a crucible (16) that includes cooling system (26) designed to extract heat from the crucible using cooling tubes (28) and which would read on a directional solidification cooling system and further includes a control gas system (30 and 32) (Also See Col 2 Lines 47-72 and Col 3 Lines 1-75).

Wilson 717 however fails to teach the specified teachings of the particulars of the crucible designed and enclosed in the Wilson 717 apparatus.

However Pinkhasov 711 teaches a crucible that read on the particulars defined in claim 8 and would be ideally suitable to change the crucible of Wilson 717 and enclose the crucible designed by Pinkhasov 711.

It would be obvious at the time of the invention to one with ordinary skill in the art to swap out the crucible taught by Wilson 717 with that of Pinkhasov 711 to further optimize the processing and apparatus conditions pertaining to the particulars of growing a crystalline material like that of single silicon crystal ingots.

11) Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711) in further view of Yamagishi (US Patent No. 5,788,718).

The hypothetical device of Wilson 717 and Pinkhasov 711 teaches an apparatus system that reads on applicant's claimed invention (See aforementioned rejection for details). However they both fail to teach the use of a graphite base container along with the crucible.

Yamagishi 718 as explained in the set of rejections pertaining to claim 3, teaches the use of a crucible with a graphite as a material as part of the base container. The reason being that it is a good thermal conductor.

Therefore it would be obvious at the time of the invention to one with ordinary skill in the art to modify the teachings of Wilson 717 and Pinkhasov 711 with that of Yamagishi 718 to include a base container comprised of graphite as



well in order to take advantage of the material's good thermal conduction as well further optimize the apparatus's processing conditions depending on the material processed.

12) Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson (US Patent No. 3,503,717) in view of Pinkhasov (US Patent No. 4,565,711) in further view of (JP 60141696A).

The hypothetical device of Wilson 717 and Pinkhasov 711 teaches an apparatus system that reads on applicant's claimed invention (See aforementioned rejection for details). However they both fail to teach the initial layer of boron nitride on the crucible followed by the silicon nitride ontop of the boron nitride.

JP 696 pertains to a single crystal growth container by forming a silicon nitride then boron nitride layer on a quartz container. In other words JP 696 teaches a quartz container for example a crucible that has a silicon nitride layer coating and then ontop a boron nitride layer unlike how applicant has claimed the crucible with a boron nitride followed by the silicon nitride layer. As well Pinkhasov 711 teaches that both silicon and boron nitride layers are seen as coating equivalents. As well JP 696 teaches the crucible but the coatings in reverse order, but exemplifies that the additional coating enables good adhesion with a middle layer coating between

the external coating layer and the crucible, as well aid in preventing any deterioration or contamination of the liquid crystal forming from contact with the crucible.

Therefore at the time of the invention it would be obvious to one with ordinary skill in the art to understand that boron and silicon nitride coatings are seen as equivalents and one would want to put an additional coating layer to maintain better adhesion between the crucible and external coating layer as well, further ensure any possible contamination from occurring between the crucible and the liquid crystal melt. Thus the teachings of JP 696 would further optimize the apparatus and conditions that may be put forth on the hypothetical device taught by Wilson 717 and Pinkhasov 711.

### ***Response to Arguments***

13) Applicant's arguments filed 8/4/06 have been fully considered but they are not persuasive. Examiner would like to point out the following indiscrepancies.

A) Applicant's contend that Pinkhasov 711 does not teach multiple layer coatings. Examiner understands that it does not therefore utilizing a secondary reference for the additional coating layer teaching. However that argument is moot because claim 1 recites "a coating layer" which examiner reiterates can be found in

the specification as noted in the aforementioned rejection, that coating layer being one of which is boron nitride.

B) Furthermore none of the claims recite the limitation of multiple crucibles, they instead recited “base container includes multiple components”. It is a “crucible” comprising a “base container”. There is no mention of “multiple crucibles” nor any specificity as to what is meant by “multiple components”. The turntable (11), vapor generator (13), and counter-electrode (21) are indeed multiple components that interact with the base container as clearly shown in Figure 1.

C) The prior art teaches a cooling system that is capable and operable of acting in coordination of a direction. Applicant’s argument stemming that the prior art does not teach what applicant recites in their specification can not be considered, because the specification is not what is claimed by application. Only time specification can truly be considered to be read into the claim language are means plus function claims, which applicant does not utilize.

D) Applicant does not contend why the references cannot be combined to derive said claim limitations. The argument regarding interchangeability is respectfully considered but there is no argument or teachings why that could not understood or deemed obvious as noted by the examiner in the rejections.

***Conclusion***

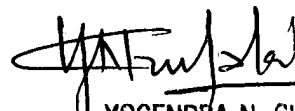
14) Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to G. Nagesh Rao whose telephone number is (571) 272-2946. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on (571)272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
YOGENDRA N. GUPTA  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1722

GNR